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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number: WO 93/14947
B60B 27/02, F16D 65/12	A1	(43) International Publication Date: 5 August 1993 (05.08.93)

(21) International Application Number: PCT/SE93/00045

(22) International Filing Date: 22 January 1993 (22.01.93)

(30) Priority data:
9200204-7 24 January 1992 (24.01.92) SE

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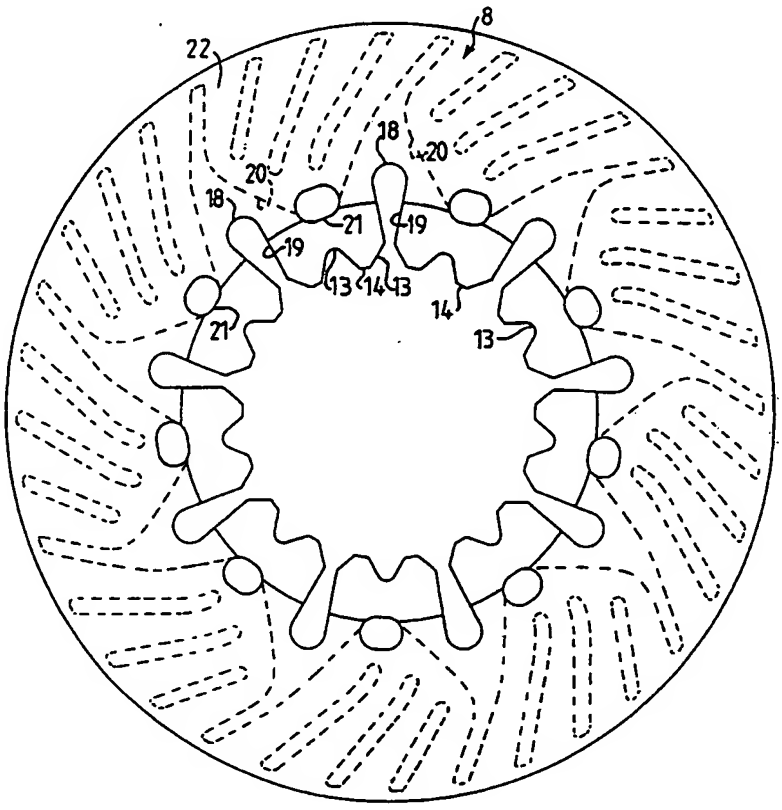
(81) Designated States: AT, AU, BB, BG, BR, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).

Published
With international search report.
In English translation (filed in Swedish).

(54) Title: WHEEL HUB AND BRAKE DISC ARRANGEMENT FOR HEAVY TRUCKS

(57) Abstract

Wheel hub and brake disc arrangement for a vehicle wheel. The wheel hub (6) has a region with sequential V-shaped ridges (10) and troughs (11). The brake disc (8) has a central hole with corresponding troughs (13) and ridges (14) for non-rotational locking of the disc to the hub. A slot (19) extends from alternate troughs in the brake disc to provide thermal relief for the hub section of the brake disc.



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Wheel hub and brake disk arrangement for heavy trucks...

The present invention relates to a wheel hub and brake disc arrangement for a vehicle wheel, comprising a hub rotatably carried on a shaft portion and presenting an outwardly facing region of non-circular cross-section, and a brake disc which is carried by said region of the hub, said brake disc having a central hole, the shape of which is adapted to the shape of said non-circular cross-section to thereby provide a mutually non-rotatable attachment of the brake disc to the hub.

Brake discs for disc brakes have previously predominantly been attached to their hubs in either of two ways, namely either by being manufactured as an integral part of the hub or by being securely screwed to a circular flange on the hub. The former method is essentially restricted to brakes for lighter vehicles, whilst the latter is also suitable for medium-sized trucks, for example trucks up to 16 tonnes in weight. For the heaviest class of truck, drum brakes have until now been almost exclusively used due i.a. to the extremely high braking torque (around 2000 kpm) in combination with the brake shoes which apply the braking effect creating problems. More specifically, these problems are due to, on the one hand, the intense heating up of the brake disc as a result of the high braking force causing the disc to warp or upset because of its rigid attachment to the hub to thereby affect its alignment with the brake caliper and, on the other hand, the unavoidable heating of the braking surfaces of the disc to a temperature higher than that of its hub region inflicting thermal stresses on the hub which may cause the hub to fracture.

A wheel hub and brake disc arrangement of the type according to the preamble of claim 1, which at least partially addresses some of the above-mentioned negative effects of a rigid attachment between the brake disc and the hub when subjected to

intense heating, has previously been proposed for light vehicles. An arrangement of this type is shown and described in DE-OS 1 800 161 in which a three or four cornered transmission ring is attached to the hub, with the corners engaging in corresponding recesses in the central hole of the brake disc. In addition to the advantage that, during heating, the disc can expand radially without warping, the arrangement also allows the disc to heat up more uniformally.

Starting out from previously known interlocking connections between a wheel hub and a brake disc, the object of the present invention can generally be said to develop a hub and brake disc arrangement which can replace previously employed drum brakes for the heaviest class of vehicles.

More precisely, the object is to provide an interlocking connection between a hub and brake disc with which the risk of fracture of the hub of the disc due to thermal stresses is eliminated.

This is achieved in accordance with the present invention by a wheel hub and brake disc arrangement of the earlier mentioned type which is characterized in that said non-circular region of the hub comprises a sequence of crests and hollows, and in that the central hole of the brake disc is provided with crests and hollows adapted to the shape of those of the hub, and in that between said hollows there are arranged hollows having a different shape to that of the crests on the hub.

The present invention ensures that the radial inner hub region of the disc can expand without the risk of fracture formation when the braking surface of the disc is subjected to an extreme temperature increase during braking and thus reaches a temperature which initially is substantially higher than the temperature of the hub region.

The invention will be described in greater detail by way of example and with reference to the attached drawings, in which:

Fig. 1 shows a partial sectional elevational view of a wheel axle with a hub and brake disc arrangement according to the invention;

Fig. 2 is an end view of the brake disc of Fig. 1;

Fig. 3 is a schematic end view of a section of the inner region of the hub and the disc, and

Fig. 4 is an end view corresponding to Fig. 2 of a second embodiment.

In Fig. 1, reference numeral 1 denotes an outer end of a rigid front axle of a truck. The end of the axle presents a conical recess 2 in which a king pin 3 is affixed. A stub axle assembly 4 is pivotally carried on the king pin 3. The stub axle assembly 4 comprises a stub axle 5 on which a wheel hub 6 is carried by means of a bearing assembly 7. The hub 6 carries a brake disc 8 and the stub axle assembly 4 a not-shown brake caliper or actuation mechanism.

Instead of attaching the brake disc to the hub by means of the previous most common method, i.e. securely screwing the disc to a flange on the hub, according to the embodiment of the present invention the disc is affixed to the hub by means of an interlocking connection. To achieve this, the hub 6 is provided with a central region which has a cross section which deviates from a true circle. More exactly, the region is provided with closely spaced V-shaped ridges 10 and troughs 11. The radial inner hub region 12 of the brake disc 8 is provided with corresponding troughs 13 and ridges 14 which are adapted to cooperate with the ridges 10 and troughs 11 of the hub.

As is particularly evident from Fig. 3, the depth of the troughs 11, 13 is somewhat greater than the height of the ridges 10, 14. The troughs have a rounded base 15 whilst the ridges have a flat upper face 16 merging with flat flanks 17. Such a construction ensures surface contact over the entire

flank surface of the ridges. The disc 8 and the hub 6 are so dimensioned that, in an unloaded condition, a gap of 0.2 - 0.3 mm is present between cooperating flanks 17 on the disc and hub. In the shown embodiment the hub and disc both have eighteen troughs and ridges. The depth of the troughs corresponds to approximately 15% of the radius of the hole 16 in the disc. With a large number of troughs and ridges, for example thirty, the depth of the troughs can be around 5% of the radius.

In the embodiment shown in Fig. 2, the brake disc 8 is provided with slots 19 which extend radially inwards from alternate troughs 13 and merge into bores 18. The shown disc is a so-called ventilated disc and the bores 18 with the slots 19 communicate with adjacent ventilation passages 20 in the disc. Axial bores 21 are located between the bores 18, though these bores 21 lack the corresponding slots 19. Naturally, the bores 18 and the slots 19 can have a different shape. For example, the bores 18 may be more pronouncedly circular. The slots can be narrower or wider with parallel opposed sides so that, in the latter case, the bores 18 are in the form of a semi-circle at the base of the slots. The described arrangement with bores and slots allows the hub region of the disc to expand without the risk of it fracturing during heating of the disc friction surface 22 to a temperature higher than its radially inner hub region during braking. In order to restrict the heat transfer during heating of the brake disc 8 to other components more heat-sensitive than the hub itself, for example the bearing 7, a circular channel 23, open on one side of the hub, is provided in the hub 6 radially inside of the ridges 10. In this manner, the heat transfer path through the hub material from the disc 8 to the hub region 24 which is pressed onto the bearing 7 is extended.

In the embodiment shown in Fig. 4, the bores 18 and the slots 19 are replaced by hollows 30 which are arranged between pairs of crests 14. The depth of the hollows 30 corresponds to the height of the crests 14, and their width and slope of opposing

side faces 31 are so adapted to a pair of crests that the pair fit in the hollow.

As can be seen from Figs. 1 and 2, the disc 8 is totally symmetric. It is affixed to the hub 6 by means of a lock ring 25 located in a groove 24 in the ridges 10, a spring-washer 26 and a lock ring 28 located in a groove 27 formed towards the inner end of the hub. The symmetric shape and the symmetric attachment, together with the axial movement on the hub which the spring-washer permits, results in symmetric thermal deformation, even wear of the disc's friction surfaces, minimal risk of brake torque variations, and simple assembly.

Claims

1. Wheel hub and brake disc arrangement for a vehicle wheel, comprising a hub rotatably carried on a shaft portion and presenting an outwardly facing region of non-circular cross-section, and a brake disc which is carried by said region of the hub, said brake disc having a central hole, the shape of which is adapted to the shape of said non-circular cross-section to thereby provide a mutually non-rotatable attachment of the brake disc to the hub, c h a r a c t e r i z e d i n that said non-circular region of the hub comprises a sequence of crests (10) and hollows (11), and in that the central hole of the brake disc is provided with crests (14) and hollows (13) adapted to the shape of those of the hub (6), and in that between said hollows (13) there are arranged hollows (13, 18, 19; 30) having a different shape to that of the crests (10) on the hub.

2. Arrangement according to claim 1, c h a r a c t e r - i z e d i n that uniformally spaced axial bores (18, 21) are provided around the central hole of the disc radially externally of at least certain hollows (13) in the disc and communicate with the base of respective adjacent hollows via slots (19).

3. Arrangement according to claim 2, c h a r a c t e r - i z e d i n that an axial bore is provided in the disc radially inside of each hollow (13), and in that certain uniformally spaced bores (18) communicate with an adjacent hollow (13).

4. Arrangement according to claim 2 or 3, c h a r a c - t e r i z e d i n that at least certain of said axial bores (18) communicate with ventilation passages (20) in the disc.

5. Arrangement according to claim 1, c h a r a c t e r - i z e d i n that the depth and width of the latter-mentioned hollows (30) are adapted to the height and width of a pair of adjacent crests (10) on the hub.

6. Arrangement according to any one of claims 1 to 5, c h a r a c t e r i z e d i n that said first-mentioned hollows and crests are formed by V-shaped troughs (13) and ridges (14).

7. Arrangement according to any one of claims 1 to 6, c h a r a c t e r i z e d i n that, on at least one side, the disc cooperates with an axially resilient element (26) carried by the hub, which element permits restricted axial movement of the disc relative to the hub.

8. Arrangement according to any one of claims 1 to 7, c h a r a c t e r i z e d i n that the disc is symmetric.

9. Arrangement according to any one of claims 1 to 8, c h a r a c t e r i z e d i n that a circular channel (23), open on one side of the hub, is provided in the hub (6) radially inside of the region provided with ridges and troughs.

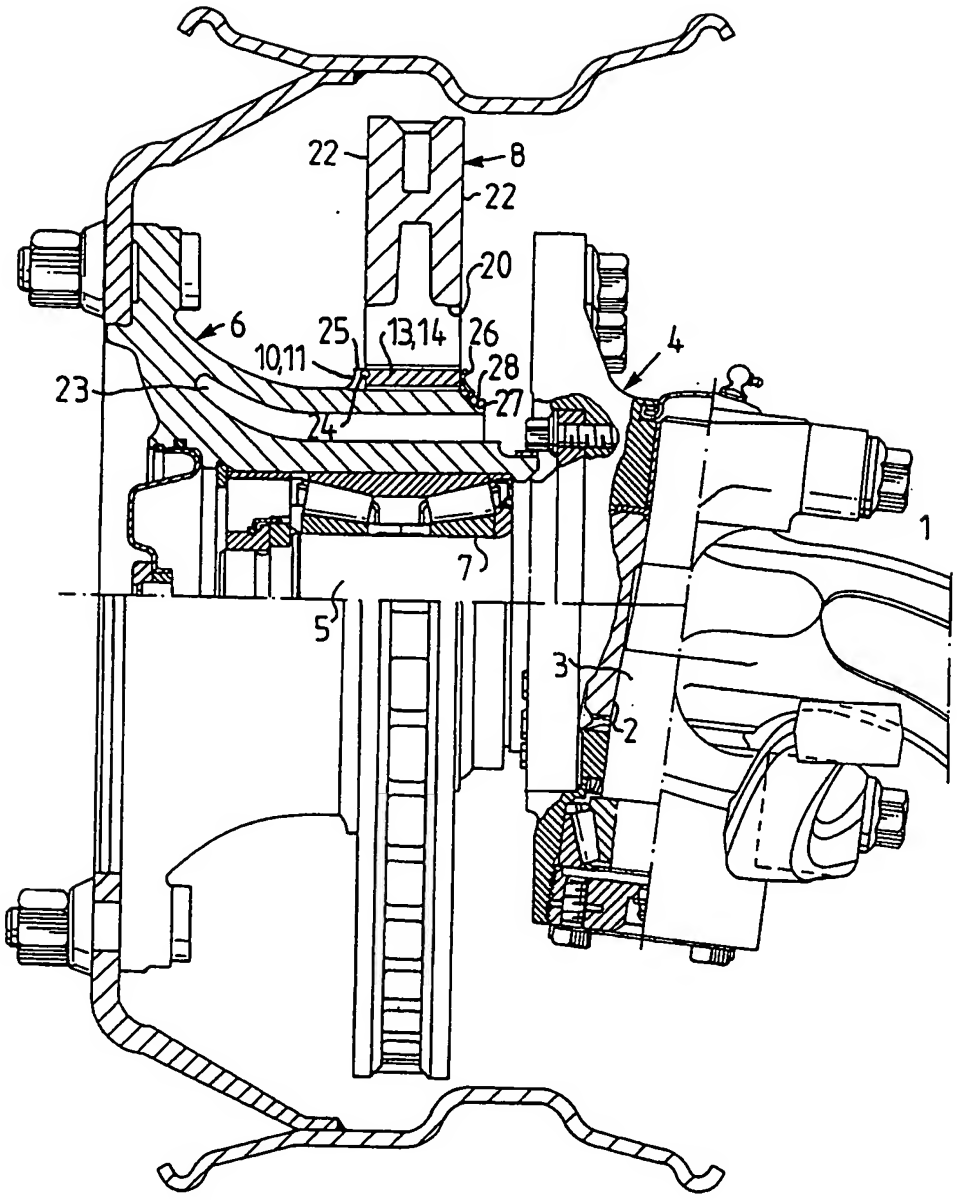


FIG.1

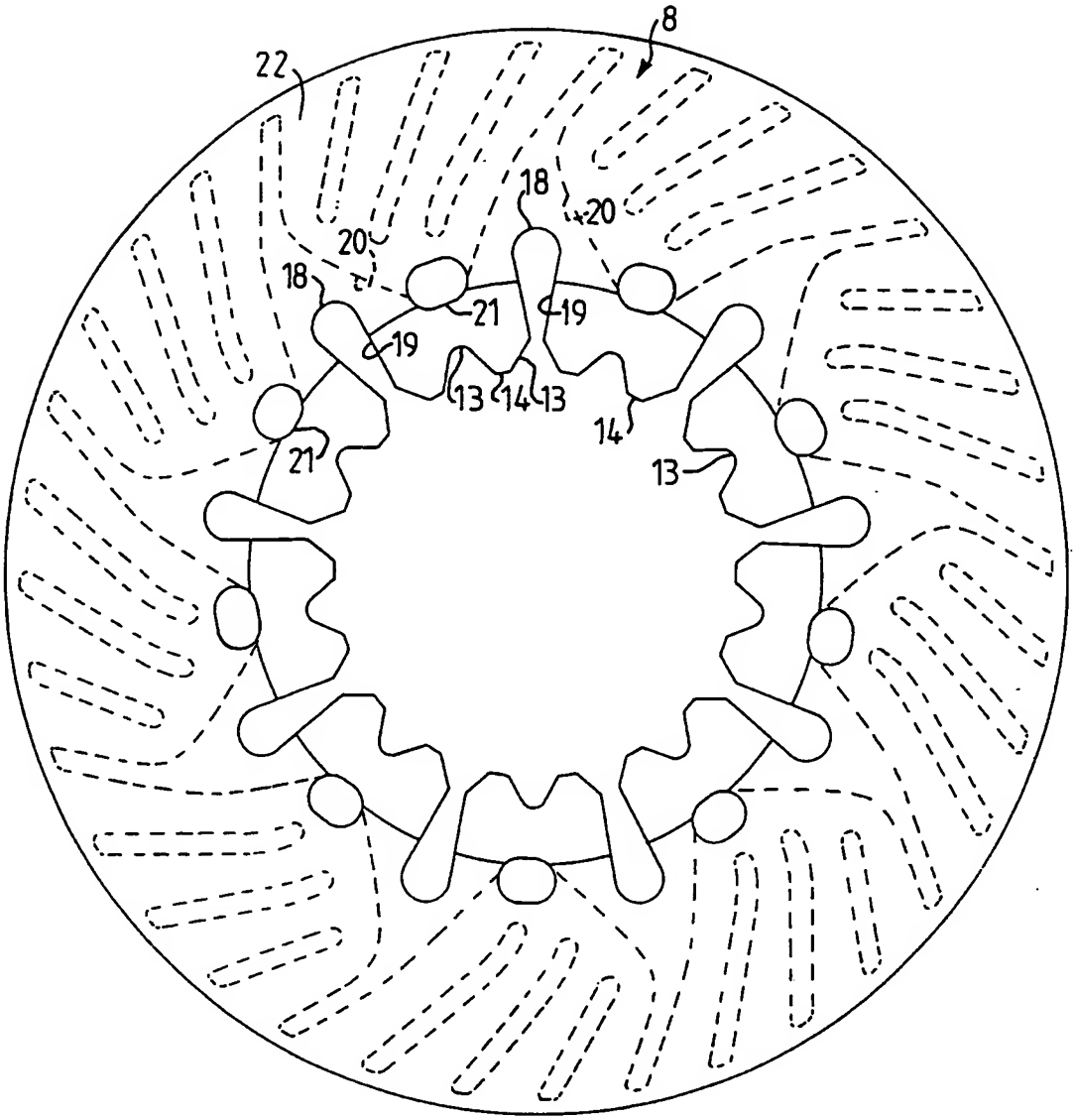
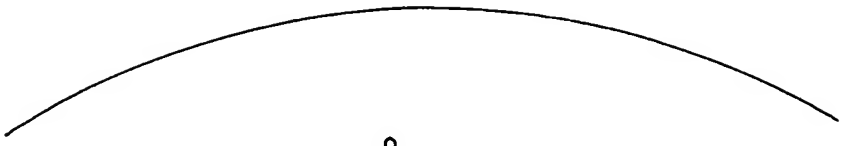


FIG.2



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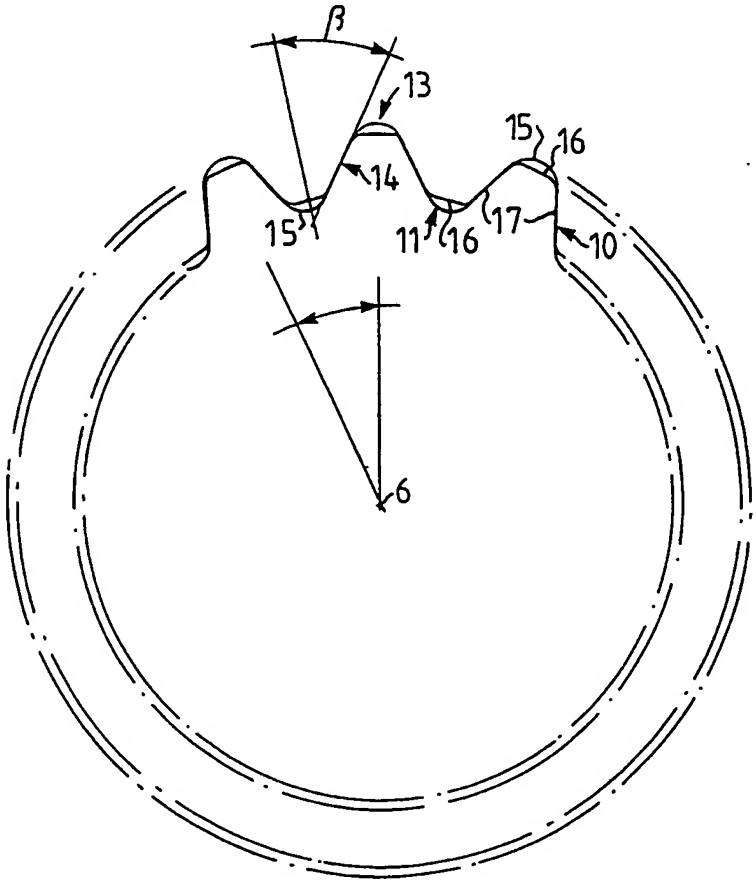

FIG.3

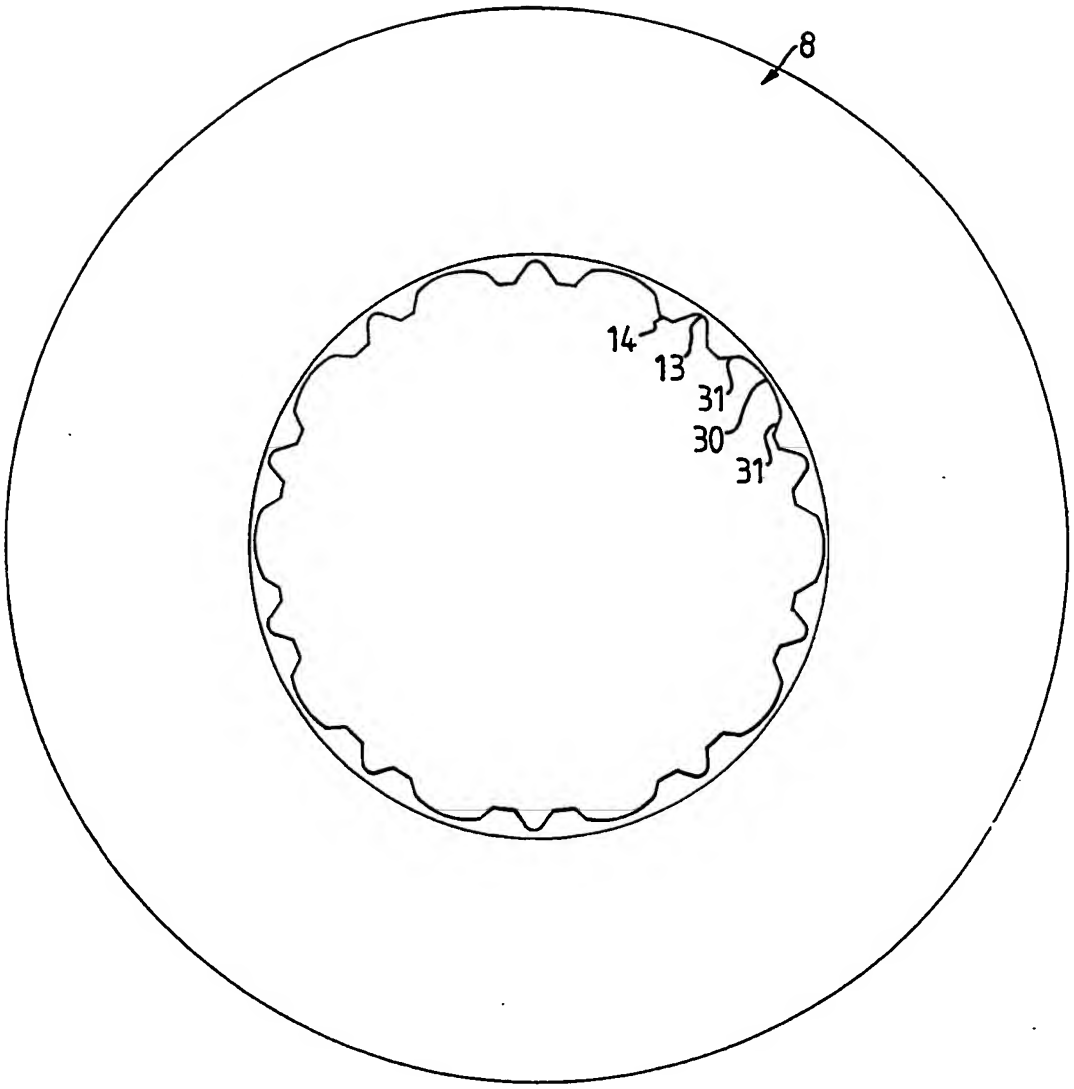

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 93/00045

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: B60B 27/02, F16D 65/12
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: B60B, F16D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE, C, 182186 (THE BENDIX CORP.), 8 January 1963 (08.01.63)	1
A	DE, A1, 2807485 (ALFRED TEVES GMBH), 23 August 1979 (23.08.79)	1
A	DE, A1, 2919128 (GIRLING LTD.), 22 November 1979 (22.11.79)	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

29/01/93

International application No.
PCT/SE 93/00045

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-C- 182186	08/01/63	NONE	
DE-A1- 2807485	23/08/79	FR-A,B- 2418385	21/09/79
		GB-A,B- 2015122	05/09/79
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		GB-A,B- 2021218	28/11/79
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